Fire Control for the Army After Next

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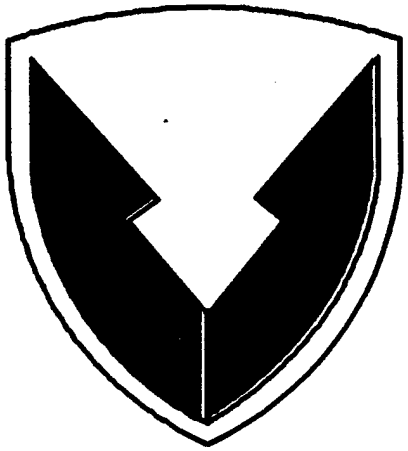
U.S. Army Armament Research, Development, and Engineering Center



U.S. Army Materiel Command

Charles Seitz

Indirect Fire Branch
Fire Control & Software Engineering Division

747

ASSUMPTIONS

- Limited to *2025* time frame
- *Guns & Bullets* remain primary
- *Compatible* with current weapons
- *More* automation
- *Better* performance

FUTURE PERSPECTIVE

- Essential fire control system functions will remain the same
- Novel mission scenarios & tactics will challenge designers
- Performance keys -- Computers & tactical database management
  - Complete knowledge of total tactical scenario
  - Prioritized mission information -- non-critical data filtered
  - Networked firing units for optimal joint effectiveness

SYSTEM INTEGRATION

- Fire control systems integrated into the digital battlefield
  - Tactical data continuously streams from satellites
  - Decision aids sort through targeting & tactical options
  - Fire missions coordinated through command net
- Object Oriented hardware & software design philosophy
  - Base modules common to all applications
  - Functions extendible to a generic application
  - Functions overridden for a very specific application

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CORE FIRE CONTROL TECHNOLOGIES

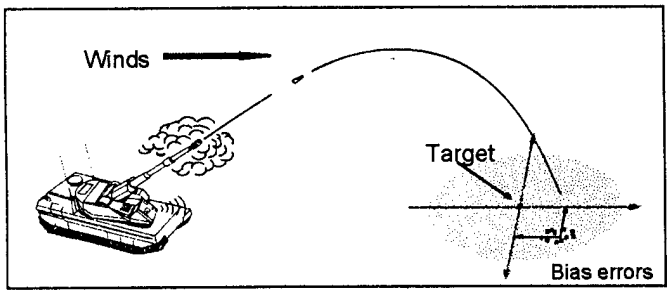
- Sensors (onboard & internal, remote & external)
- Processing hardware
- Software languages and architectures
- Ballistics and aiming
- Controls and displays
- System reliability and maintainability
- Manufacturing processes

SENSORS

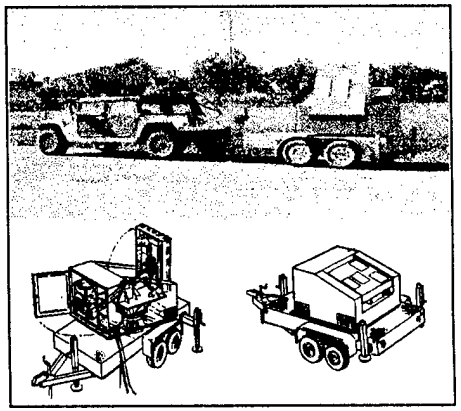
- Multiple sensing channels share common optics
- Microwave devices for target imaging and munitions guidance
- True sensor fusion finally achieved
- Micro-machines tag targets
- Robotic targeting sensors deployed away from firing site

PROJECTILE TRACKING SYSTEM

AUTO REGISTRATION



TOWED PTS



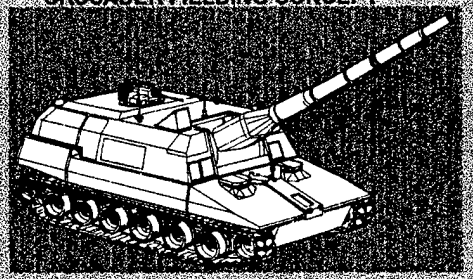
- HIGH ACCURACY
- LONG RANGE PROJECTILE TRACKING
- AUTONOMOUS OPERATION
- ELIMINATES FORWARD OBSERVERS
- ALL WEATHER
- POTENTIAL FOR PROJECTILE/MANEUVER CONTROL

AUTO REGISTRATION OF FIRE

IMPACT PREDICTION

PREDICTED FIRE

CRUSADER FIELDING CONCEPT



(TRANSITIONED FROM SBIR)

REAL TIME MET EXTRACTION

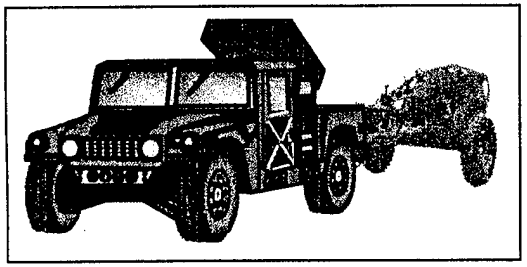
PROJECTILE DRAG COEFFICIENTS

MUZZLE TUBE BEND

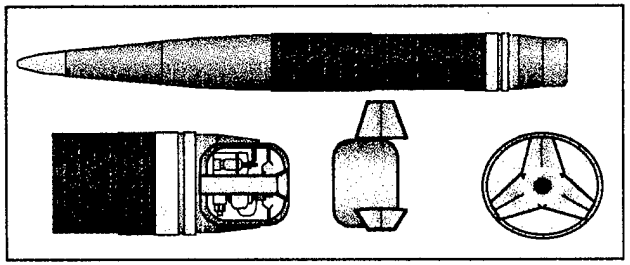
MUZZLE VELOCITY

- FIELD ARTILLERY
- TOWED FIELD ARTILLERY
- MORTARS
- ROCKETS / MISSILES
- RANGE INSTRUMENTATION

VEHICLE MOUNTED PTS



MANEUVER MODULE



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DATA PROCESSING

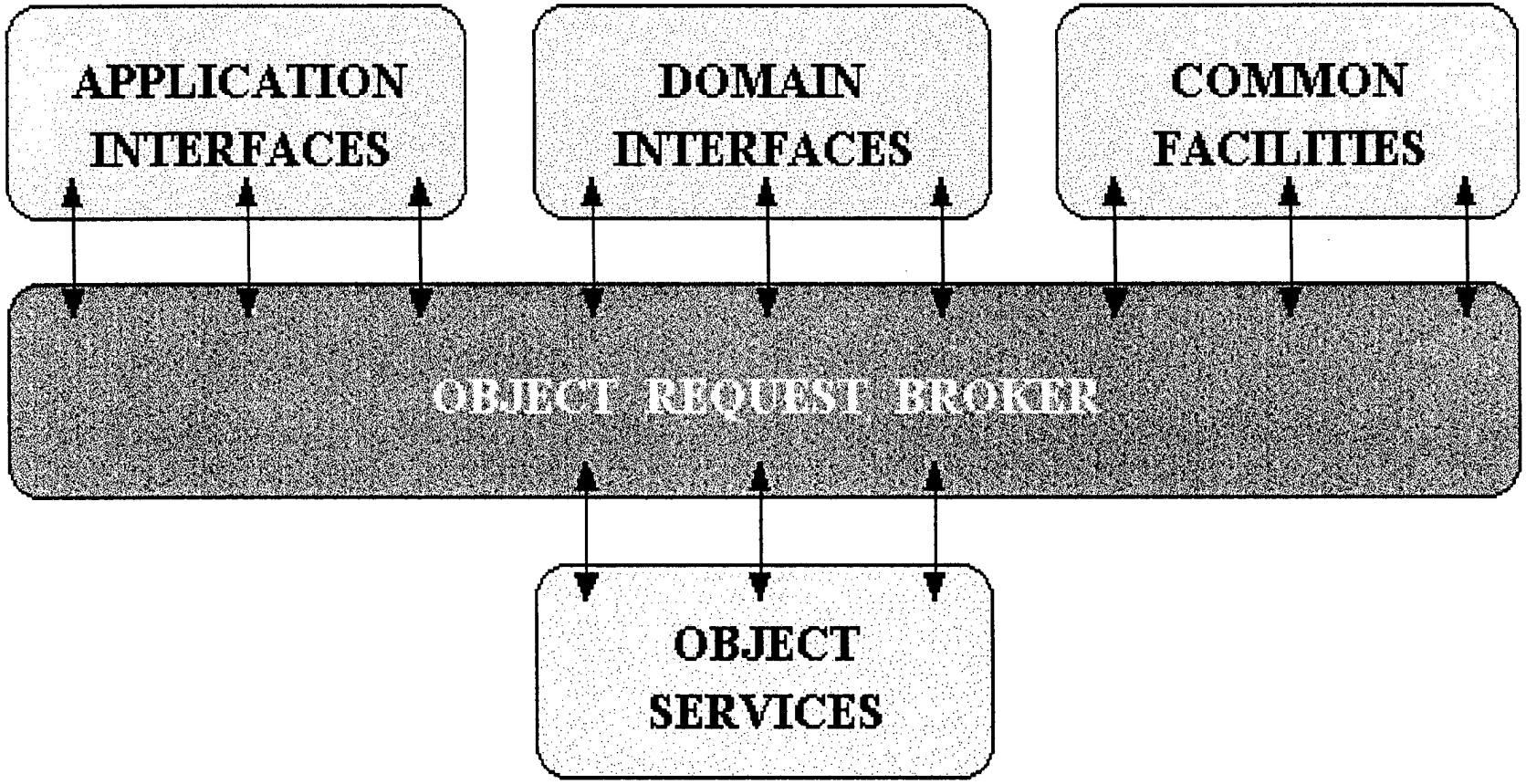
Hardware

Highest computational speeds attained
Megascale chips at manufacturing limits
Non-transistor architectures emerge
Revolutionary mass data storage devices

Software

One totally flexible programming standard
Dynamically configurable architecture
True multi-tasking operating system

SOFTWARE ARCHITECTURES



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BALLISTICS & AIMING

- All ballistic weapons employ a fire control processor
- A platform independent *Ballistic Kernel* computes firing solutions
  - Precise dynamic ballistic performance parameters
  - Robust 6 Degree Of Freedom trajectory simulation
  - Modeling of computational fluid dynamics
- Extended functionality
  - Miss distance sensing eliminates biasing errors
  - Aim errors canceled through in-flight control of projectiles
  - Real-time battlefield MET data
- Novel techniques for weapon stabilization developed

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NOVEL GUN STABILIZATION TECHNOLOGY

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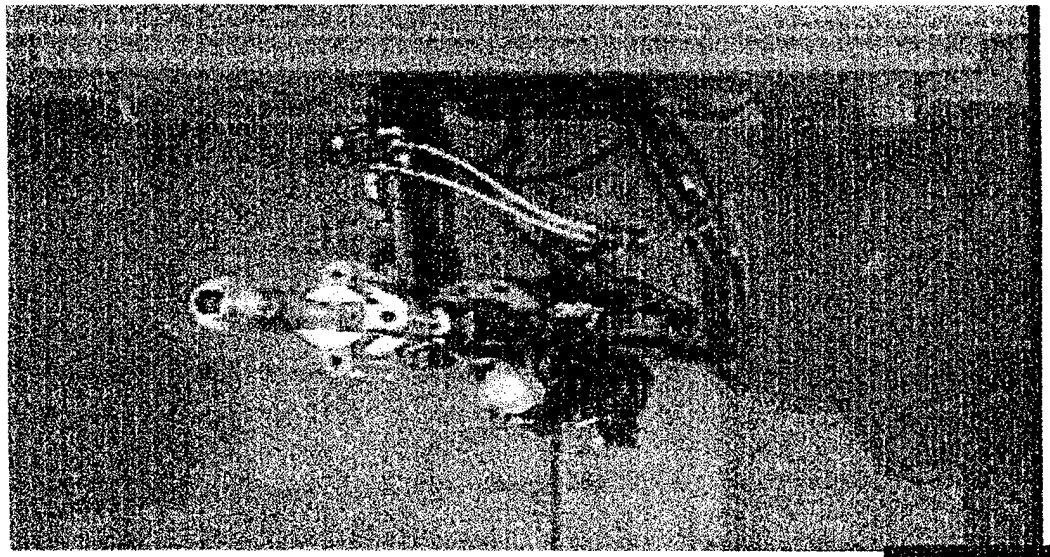

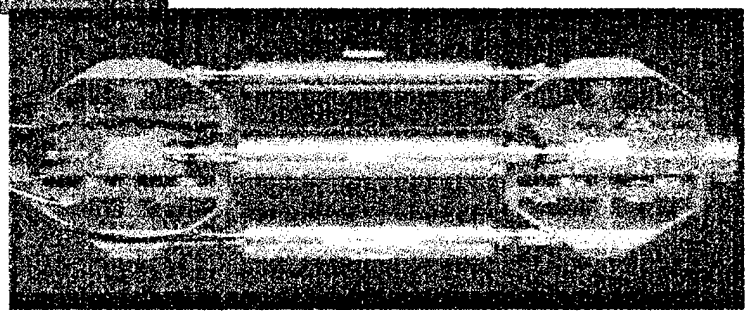

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CONTROLS AND DISPLAYS

An extension of the soldier

Controls

Primary manual controls remain
System responds to verbal commands
System responds to mental commands
Controls integrated with virtual reality (VR)

Displays

High resolution stereo displays bolster VR
Conventional optics replaced by emitter arrays
Tactical images sent directly to the eye

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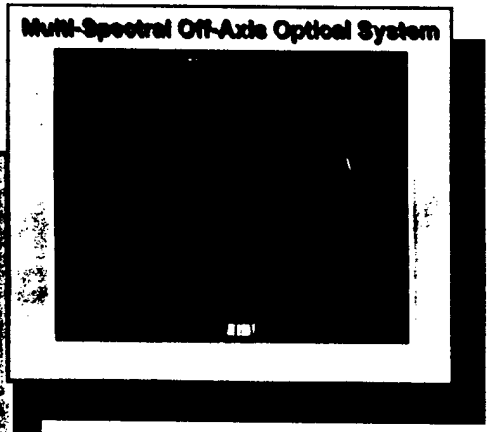
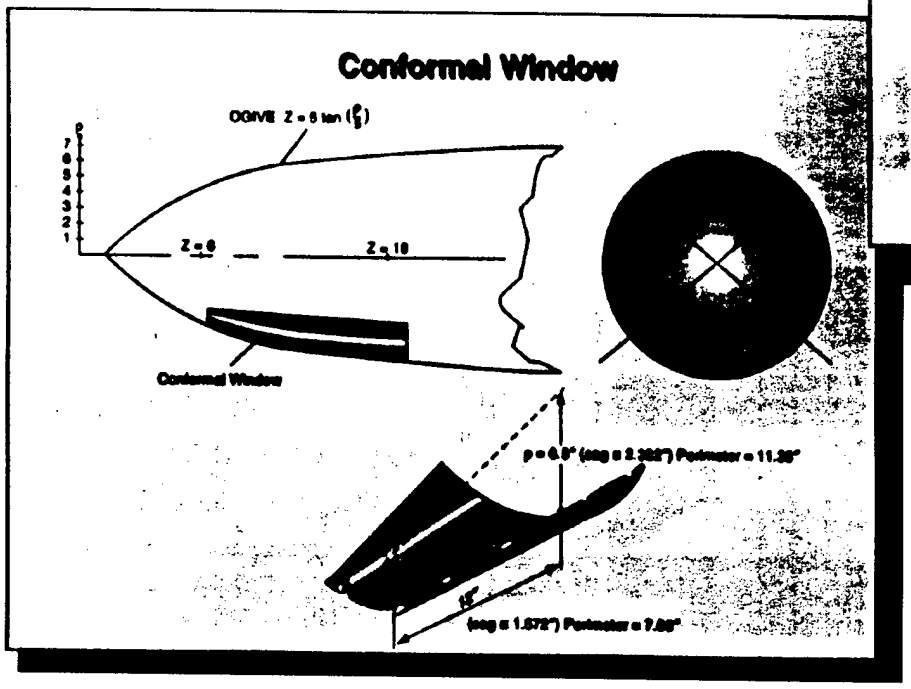
RELIABILITY & MAINTAINABILITY

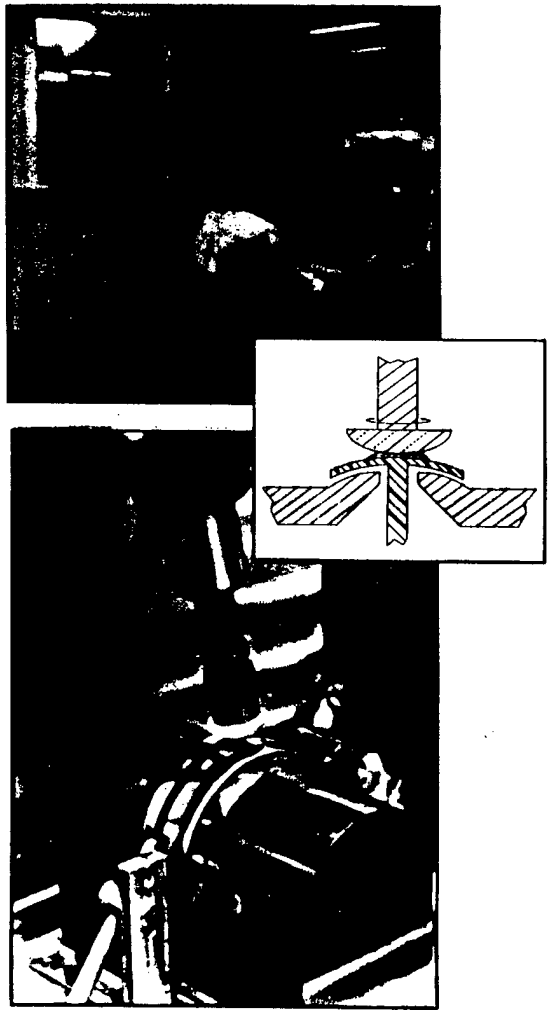
- Multiple redundancy for critical functions
- Failed items dynamicaly *auto-repaired* through self-diagnosis
- Field configurable modules minimize down-time
- *Reprogramming* of system functions by common support devices
- *Remote* troubleshooting through battlefield digitization

Conformal Optics

DARPA Physical Optics Program
(TI, Boeing, RPC, Sinclair, COM)







New Generation MRF Machine

- Convex - to hemisphere
- Plano (only x-axis motion)
- Concave - greater than 200 mm

Convex vertical wheel rim supporting MR fluid is a section of a 150 mm diameter sphere.

- Part to wheel rim gap ≈ 1.0 ± .05 mm
- Wheel 0 – 1,000 rpm
- Spindle 10 – 300 rpm

SUMMARY

The future is different ...

System complements the soldier
Greatly expanded functionality
Orders of magnitude increase in sophistication

Yet, it is familiar ...

Customary crew tasks will be performed
Sensors gage relevant engagement parameters
Processors will manipulate data
Prime movers will accomplish weapon positioning
Soldiers in control ... *with confidence*

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THE FIRE CONTROL AAN GROUP

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